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Title: Transport Visualization - TranzViz

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Transport Visualization - TranzViz

Tranzviz visualization software is developed and distributed by Roger Martz
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XCP-3: Monte Carlo Codes, Methods and Applications

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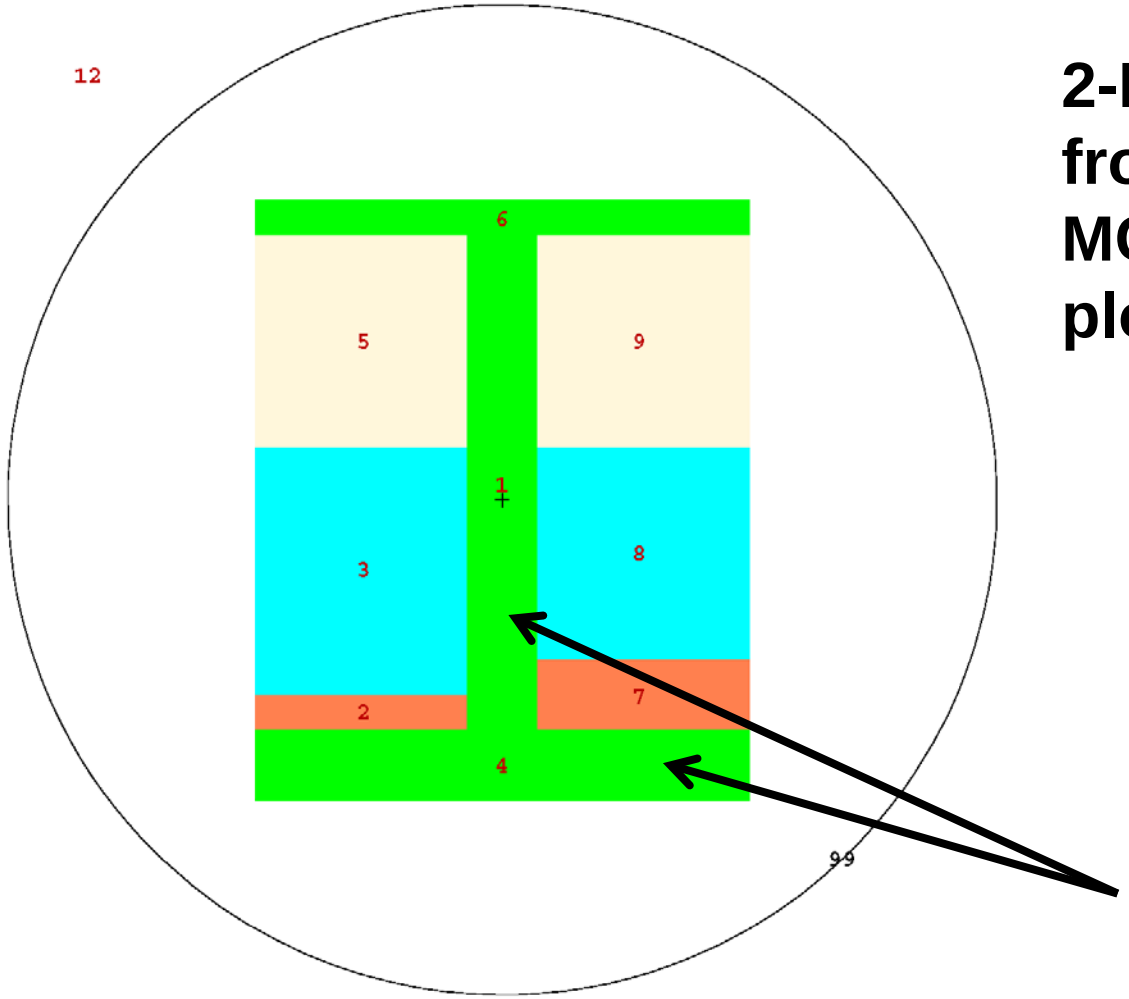
UM Exercise #1: Bulkhead

Construct Input From Existing Abaqus File

- Use the *um_pre_op* program to construct a skeleton input
- Examine the output from *um_pre_op*
- Complete the input
- Run the calculation with threads
- Visualize the results using TranzViz
- **STOP!** We need to discuss the geometry & *um_pre_op* first.

The Bulkhead Geometry



2-D slice from MCNP6 plotter

We Plan on Specifying a Co60 Volume Source Here

Preprocessor Utility: um_pre_op

um_pre_op –h

```
** PRE-PROCESSOR PROGRAM FOR UNSTRUCTURED MESH CAPABILITY **
    Functions:

    1) Create MCNP input file from Abaqus .inp file
    2) Convert MCNP simple lattice to Abaqus .inp file (hex geometry)
    3) Volume check the Abaqus .inp file and pseudo-cells
    4) Element check the Abaqus .inp file

    Command Line Arguments:
    -b,   --back         background material for input file
    -h,   --help         summary of features & arguments
    -m,   --mcnp         generate MCNP skeleton input file -- (1)
    -o,   --output       output file name
    -cf,  --controlfile  file with lattice conversion controls
    -dc,  --datacards    data cards file to include
    -ex,  --extension    output file extension
    -ff,  --fillfile     file with lattice fill description
    -lc,  --latconvert   convert simple lattice to Abaqus  -- (2)
    -vc,  --volcheck     volume check the .inp file        -- (3)
    -ec,  --elementcheck element check the .inp file       -- (4)
    -len, --length       scale factor for mesh dimensions
```

First Steps

- **Copy the um_bulkhead_hex.abaq.inp and bulkhead_data_cards.txt from the classroom exercise folder to your work directory**
- **Modify the .abaq.inp file to allow volume source specification to the front wall and stiffener parts**
- **Examine the .abaq.inp assembly information → take note of the instance ordering for the source parts**
- **Run the um_pre_op script using the following command line argument**
  - um_pre_op –m um_bulkhead_hex.abaq.inp –o Bulkhead-Vol.mcnp.inp –dc bulkhead_data_cards.txt

Edit the um_bulkhad_hex.abaq.inp → source tag

- **Add source tag to parts: front_wall, stiffener**
  - Hint: In a text editor search for Part-stiffener, then elset, add the source tag then repeat for front_wall

```
*Nset, nset=Set-material_tally_026, generate
    1,  4205,     1
*Elset, elset=Set-material_tally_source_026, generate
    1,  3136,     1
*Nset, nset=Set-2, generate
    1,  4205,     1
*Elset, elset=Set-2, generate
    1,  3136,     1
```

Examine the .abaq.inp Assembly Data to Determine Cell Identity

```
** ASSEMBLY
**
*Assembly, name=Assembly
**
*Instance, name=Part-stiffener-1, part=Part-stiffener
        -7.,          0.,          0.
*End Instance
**
*Instance, name=Part-left_liner-1, part=Part-left_liner
*End Instance
**
*Instance, name=Part-left_water-1, part=Part-left_water
*End Instance
**
*Instance, name=Part-front_wall-1, part=Part-front_wall
*End Instance
**
*Instance, name=Part-left_air-1, part=Part-left_air
*End Instance
**
*Instance, name=Part-back_wall-1, part=Part-back_wall
*End Instance
**
*Instance, name=Part-right_liner-1, part=Part-right_liner
*End Instance
**
*Instance, name=Part-right_water-1, part=Part-right_water
*End Instance
**
*Instance, name=Part-right_air-1, part=Part-right_air
*End Instance
**
*End Assembly
```

→ Note Stiffener is the 1st Part → 1st pseducell

→ Note Stiffener is the 4th Part → 1st pseducell

The bulkhead_data_cards File

```
c
c  --------------
c  Material Cards
c
m1    1000 2     8000 1
m2    8000 0.23  7000 0.76
m26  26000 1.0
m82  82000 1.0
c
imp:p 1 10R 0
c
mode p
c
nps   1e6
prdmp 1e5 1e5 0 1 1e5
c
print -85 -86
c
c Tallies
f4:p 6
c
c Mesh Tally to Visualize Source
Distribution
fmesh14:p ORIGIN=-7 0 0 TYPE=source
         IMESH=7  IINTS=15
         JMESH=17 JINTS=17
         KMESH=14 KINTS=14
```

Run *um_pre_op*

Generate a skeleton input file using the bulkhead_data_cards.

```
um_pre_op  –m um_bulkhead_hex.inp  –dc bulkhead_data_cards
                    –o Bulkhead-Vol.mcnp.inp
```

Output to the screen (1)

```
** um_pre_op option: generating MCNP input file for unstructured mesh **

 ***************************************
 ***** ABAQUS Input File Statistics *****
 ***************************************

       File:          um_bulkhead_hex.inp

       Number of Parts                                        9
       Number of Assemblies                                   1
       Number of Instances                                    9
       Number of Materials                                    4
       Number of Parts with 1st Order Tets                    0
       Number of Parts with 1st Order Pents                   0
       Number of Parts with 1st Order Hexs                    9
       Number of Parts with 2nd Order Tets                    0
       Number of Parts with 2nd Order Pents                   0
       Number of Parts with 2nd Order Hexs                    0

                                    UNASSEMBLED Maximums
       Total Number of 1st Order Tets                         0
       Total Number of 1st Order Pents                        0
       Total Number of 1st Order Hexs                     12628
       Total Number of 2nd Order Tets                         0
       Total Number of 2nd Order Pents                        0
       Total Number of 2nd Order Hexs                         0
       Total Number of Elements                           12628
       Total Number of Nodes                              17748
       Max   Number of Pseudo-Cells                          18

                                    PART Maximums
       Maximum Number of Nodes                             4205
       Maximum Number of 1st Order Tets                       0
       Maximum Number of 1st Order Pents                      0
       Maximum Number of 1st Order Hexs                    3136
       Maximum Number of 2nd Order Tets                       0
       Maximum Number of 2nd Order Pents                      0
       Maximum Number of 2nd Order Hexs                       0
       Maximum Number of Elements                          3136
       Maximum Number of Materials                            1
```

Output to the screen (2)

```
************************************************************************************************************************ *  Building the Global Tracking Model
* ************************************************************************************************************************

 Adding Instance #     1   :  part-stiffener-1P1                          [Part:]   part-stiffenerP1

        First 1st Order TET  element number:            0      Last  1st Order TET  element number:            0
        First 1st Order PENT element number:            0      Last  1st Order PENT element number:            0
        First 1st Order HEX  element number:            1      Last  1st Order HEX  element number:         3136
        First 2nd Order TET  element number:            0      Last  2nd Order TET  element number:            0
        First 2nd Order PENT element number:            0      Last  2nd Order PENT element number:            0
        First 2nd Order HEX  element number:            0      Last  2nd Order HEX  element number:            0

                                                               Last GLOBAL element         :         3136
                                                               Last GLOBAL node            :         4205

        Translate:     -7.000000000000000     0.000000000000000     0.000000000000000
        Rotate   :      0.000000000000000     0.000000000000000     0.000000000000000
                        0.000000000000000     0.000000000000000     0.000000000000000
                        0.000000000000000
```

Output to the screen (3)

```
 Global Model Extents
    Min X: -7.00000E+00   Max X:  7.00000E+00
    Min Y:  0.00000E+00   Max Y:  1.70000E+01
    Min Z:  0.00000E+00   Max Z:  1.40000E+01


*****************************************************************************************************************  * Pseudo-Cell Cross Reference Table
*  ************************************************************************************************************
Pseudo-Cell #    Instance #    Part #    Material #    Material Name
-------------    ----------    ------    ----------    -------------
           1             1         9            26    material-iron_026
           2             2         4            82    material-lead_082
           3             3         5             1    material-water_01
           4             4         2            26    material-iron_026
           5             5         3             2    material-air_02
           6             6         1            26    material-iron_026
           7             7         7            82    material-lead_082
           8             8         8             1    material-water_01
           9             9         6             2    material-air_02

        ********************************************************************************************************** * Global Tracking Model Complete
* ************************************************************************************************************
```

The Skeleton Input File

```
 bulkhead model with 1st order hexs for MCNP6 Class
c
c  Created from file    : um_bulkhead_hex.abaq.inp
c  Using data cards file: bulkhead_data_cards.txt
c  Created on           :  5-11-2018 @  9:41:36
c
c
c PSEUDO CELLS
01      26     -7.87400      0  u=1
02      82     -11.3500      0  u=1
03       1     -1.00000      0  u=1
04      26     -7.87400      0  u=1
05       2    -1.205000E-03  0  u=1
06      26     -7.87400      0  u=1
07      82     -11.3500      0  u=1
08       1     -1.00000      0  u=1
09       2    -1.205000E-03  0  u=1
10       0                   0  u=1
c
c LEGACY CELLS
11       0                 -99  fill=1
12       0                  99

c
c SURFACES
99  sph   0.00000E+00   8.50000E+00   7.00000E+00   1.56576E+01
```

```
c
c  DATA CARDS
embed1 meshgeo=abaqus
       mgeoin=um_bulkhead_hex.abaq.inp
       meeout=um_bulkhead_hex.abaq.eeout
       length= 1.00000E+00
       background=      10
       matcell=  1  1  2  2  3  3  4  4  5  5  6  6  7  7  8  8
9  9
c
embee4:p embed=1
c
sdef  pos= volumer
c
c
c  --------------
c  material cards
c
m1    1000 2     8000 1
m2    8000 0.23  7000 0.76
m26  26000 1.0
m82  82000 1.0
c
imp:p 1 10r 0
c
mode p
c
nps   1e6
prdmp 1e5 1e5 0 1 1e5
c
print -85 -86
c
c tallies
f4:p 6
c
c mesh tally to visualize source distribution
fmesh14:p origin=-7 0 0 type=source
         imesh=7  iints=15
         jmesh=17 jints=17
         kmesh=14 kints=14
```

Modify & Run the Bulkhead-Vol.mcnp.i file

- **Add a Co-60 Gamma Source to the Front Wall and Stiffener**

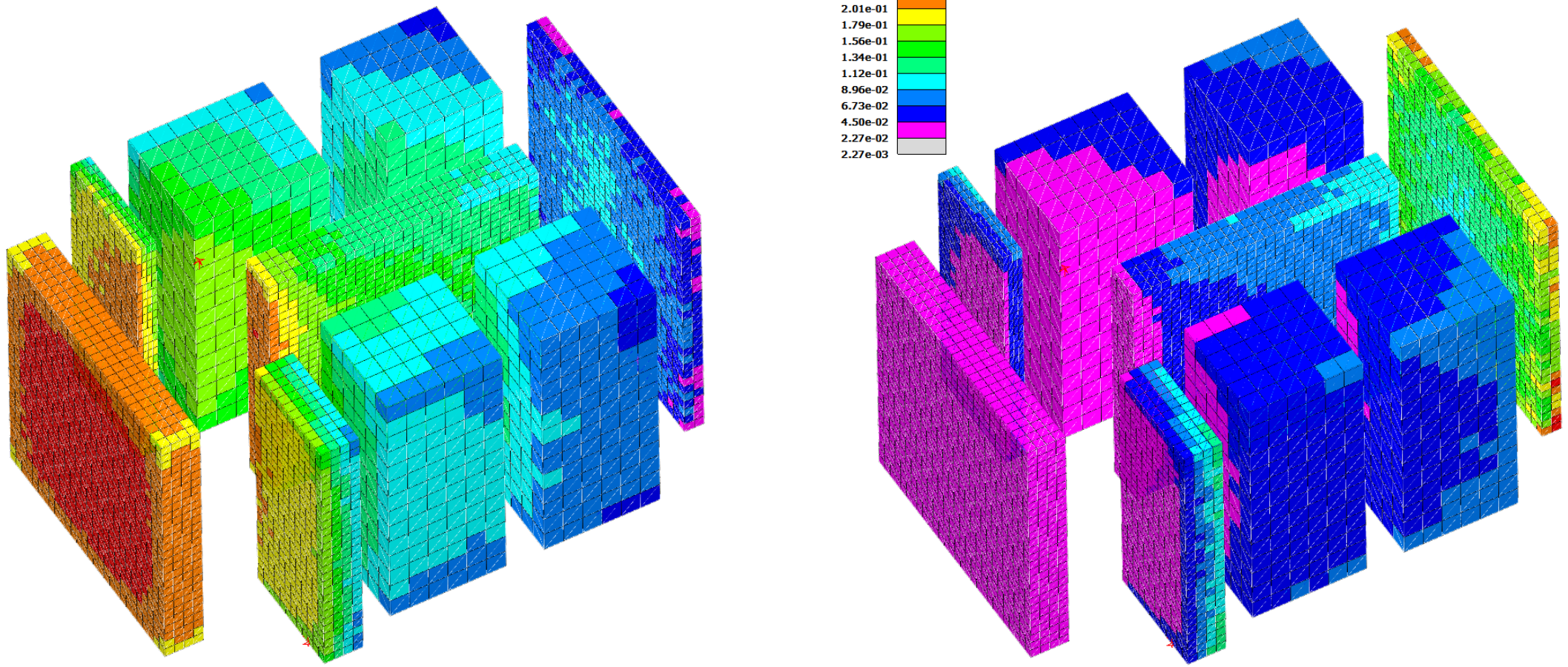
```
 sdef  pos=fcel=d1 cel=d2 erg=d3
ds1 L volumer volumer
si2 L 01  04
sp2   0.1 0.9
si3 L 1.3325 1.1732
sp3   0.5    0.5
```

- **Add input to generate errors with the gamma flux edit.**
- **Plot the geometry with MCNP6 for a sanity check.**
- **Run the calculation using threads; examine your results.**

TranzViz Demo

- **3D Visualization Tailored Specifically for Radiation Transport Applications**
- **Native ABAQUS and EEOUT Support**
- **UM Geometry and Results Visualization**

Total Gamma Flux & Relative Error



Gamma Flux Sector Plots